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A NEW CYCADOPHYTE AND ITS RELATIVES

BY

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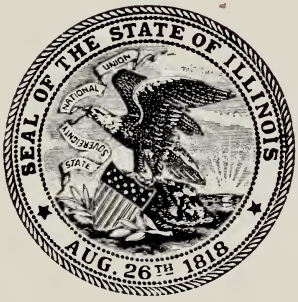

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A New Cycadophyte and its Relatives*

James M. Schopf

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Recently a new type of *Medullosa* stem has been discovered in coal balls from the Clarkson Mine, (coal No. 6) at Nashville. This stem may best be compared with the three species of *Medullosa* which have been described from the English lower Coal Measures. These are *Medullosa anglica, M. centrofilis and M. pusilla* and the beds from which they are derived are considered roughly equivalent to the Pottsville series of the lower Pennsylvanian of this country. The new stem from Nashville consequently is younger geologically than the related European forms. In the accompanying drawings the author has attempted to reconstruct cross sections to scale as the stems would appear if uncrushed or undistorted. All three English species possess three separate main steles. No doubt the English forms are most closely related but their primary structures of determinate growth differ so much in size that they must all be considered valid species. *M. centrofilis* has a small centrally placed accessory stele which further distinguishes it. A band-like internal periderm layer between the stelar region and the cortex is consistently found in all three English forms.

Instead of three steles our new Nashville *Medullosa* has but two. The stem is somewhat larger than *Medullosa anglica* as may be noted on the plate since the drawings are approximately on the same scale. The decurrent petiole bases are essentially similar although their arrangement on the stem is different. Details of histology also differ showing that this form from Nashville is distinct and not simply a distelar aberration of a typically tristelar species. Perhaps the most noteworthy single feature is the extreme asymmetry of the two steles in this new species. The secondary wood is strongly developed on each vascular member toward the center but only slightly developed on the portion facing the stem exterior. Scott (1) has pointed out that this also occurs in *Medullosa anglica* and *M. pusilla*. Examination of De Fraine's figures of *M. centrofilis* show the same condition exists for it too, but in none of these species is the asymmetry of growth so extreme as in the Nashville stem. Whatever the cause for the preponderant secondary growth toward the center of the stem may be, its occurrence in all four of these species indicates that it has some definite significance. A band-like internal periderm layer is present enclosing the stelar tissues of the Nashville *Medullosa* as in the English stems.

Sutcliffia insignis has been suggested by De Fraine as representing a primitive type among the Medullosaceae from which the polystelar forms could have been evolved. A reconstruction (more tentative than the other sketches) obtained by combining features illustrated by Scott (2) and by De Fraine (3) is also included on the plate. *Sutcliffia* also possesses decurrent petioles, and a less well defined internal periderm band. There is but a single main vascular cylinder around which are a number of smaller stelar units. These latter structures give rise to the multitudinous small leaf trace bundles and on this account De Fraine regards them more as large foliar traces than as structures homologous with the central stele.

It might be inferred that the Nashville *Medullosa* is derived more directly from a *Sutcliffia* type of stem than any of the other species on account of its fewer steles, notwithstanding that our new form is of somewhat younger geologic age than any of the others mentioned. However it

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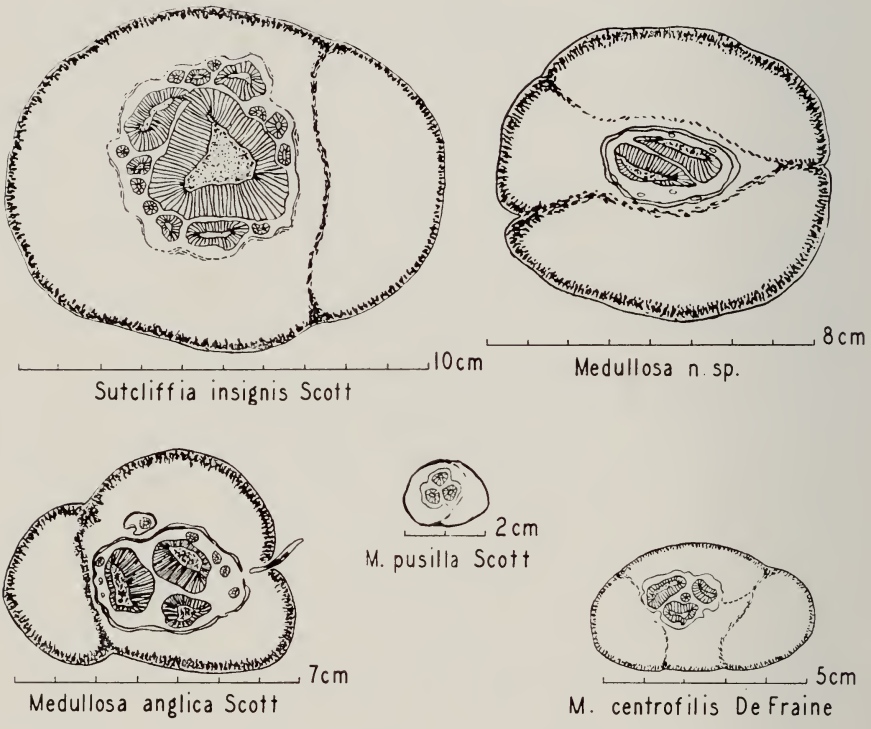
seems more likely that the reverse is the case since the asymmetry of the steles is probably a specialized feature and this is more extreme in the Nashville stem than in the English Medulloseae. The distelar condition may have come about by elimination of one of the steles of a tristelar form as easily as by the division of the stele of an essentially monostelar plant. The lesser number of steles in the Nashville *Medullosa* is a feature which serves to distinguish it specifically but this character is less important in itself for judging phylogenetic position. Reduction in complexity of general stelar organization seems more in keeping with features of the histologic organization which will be discussed elsewhere[1] in connection with a diagnosis of the new plant.



CROSS-SECTIONS OF STEMS OF CERTAIN MEDULLOSACEAE

These plants, whose stem structure is so different from those typical of the present are also known to have had fern-like foliage and large nut-like seeds. The male fructification in some instances at least was remarkably large with tubular sporangia containing male spores which are also much larger and very different from the pollen of modern plants. Even in the case of the best preservations these various organs are habitually found separate from one another. This renders it scientifically impossible to make certain of the specific correlation of seed structure, characters of the male fructification or of the stem or leaf in any single instance which would be comparable with that known for plants living today. We cannot know for certain whether allied stems of different ages with specifically different structure also had different seeds or whether the seed characters were about the same in both cases. The sex organs are considered to be

conservative by modern taxonomists so the last possibility might conceivably be of common occurrence in fossil plants. As a consequence of this general situation the identification of the genus *Medullosa* is based entirely on characters of the stem. Notwithstanding this handicap the leaves, petioles, seeds, male fructifications and roots which go with these stems are sufficiently known, either from isolated cases where the organs are found in actual connection or from their constant association in the same deposits or on the basis of histologic similarities, that their general relationship is apparent. Thus it is known that several *Medullosa* stems bore foliage which is classified separately as *Alethopteris*. Structurally preserved petioles detached from their stems are designated as *Myeloxylon*. The characters used in diagnosing species of either of these genera do not necessarily correlate in the course of evolution with species variations exemplified by the stems.

Recently fructifications which are related in the Medullosaceae have been discovered. Certain of the Medullosan seeds have been named *Rotodontiospermum* and male fructifications are classified under *Dolerotheca* (in part). It is necessary to use these different names to apply to the various isolated plant organs because their specific inter-correlation cannot be proved with sufficient accuracy. Herein lies the chief difference between the taxonomy of fossil and modern plants. It must be recognized nevertheless that these fossils classified under different names have a close natural relationship to the stems previously discussed. In various instances the relationship of assembled organs, as in the case of these mentioned, may be indicated by classifying them together in a more generalized category such as a family. The reconstructions of complete plants of past ages also are based on generalizations of this sort and they have proved a most effective means of summarizing our detailed knowledge of the fossil floras.

The foregoing discussion may serve to indicate briefly the problems involved in the paleobotanic study of Medullosaceae. The new stem from Nashville lends emphasis to characters which had previously received little attention. Of course a great deal of study will be necessary before the botanical peculiarities and the relationship of this interesting group of plants become fully known. It is definitely encouraging that additional specimens are being discovered in Illinois coal balls because the European specimens known previously left many pertinent questions unanswered.

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